ND Energy Development and Transmission Committee

Regional Transmission Organizations (RTOs)

Claire Vigesaa – Executive Director
ND Transmission Authority
August 7, 2023

NDTA North Dakota Transmission Authority

NORTH Dakota Be Legendary.

RTO – History…Purpose

Energy Policy Act of 1992

- FERC Order 888 in 1996
  - Provided for the creation of ISOs to consolidate and manage the operation of transmission facilities to provide nondiscriminatory open transmission service for all generators and transmission customers

FERC

- Coordinates, controls and monitors multi-state electric grids. Since transfer of electricity between states is considered interstate commerce; electric grids spanning multiple states are therefore regulated by the Federal Energy Regulatory Commission (FERC)

NERC

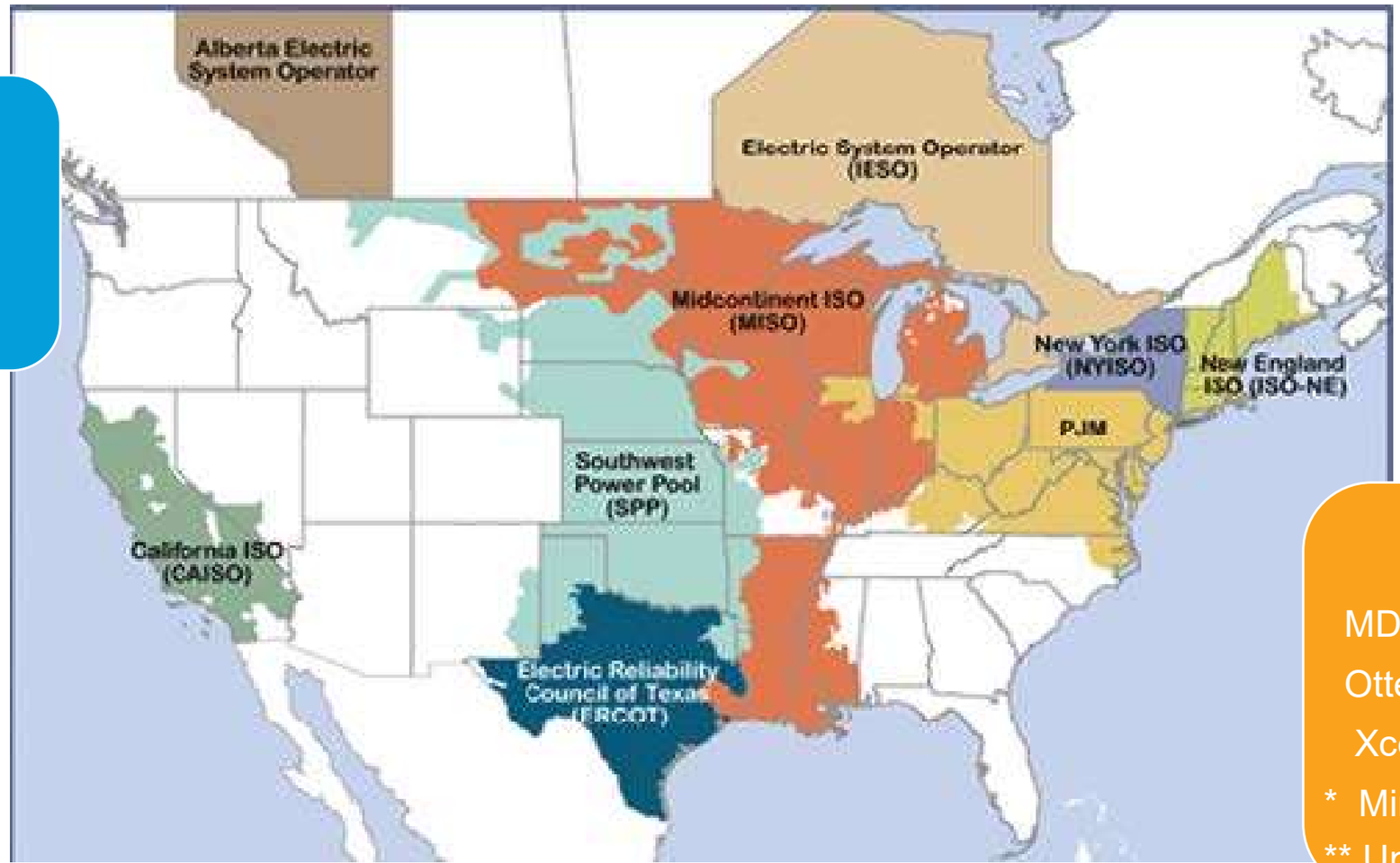
- North American Electric Reliability Corporation (NERC) is a not-for-profit international regulatory authority whose mission is to assure the effective and efficient reduction of risks to the reliability and security of the grid. NERC develops and enforces reliability standards.

Independent System Operators

SPP

Basin & Members

WAPA



MISO

MDU

Otter Tail Power

Xcel

* Minnkota Power

** Upper Missouri Power

RTO – ISO Role

Electric Transmission

- Transmission System Planning (Member Driven)
- Generation Interconnection
- Transmission Operation (WAPA is the Transmission Operator for our region)

Markets

- Day Ahead and Real-Time

RTO – ISO Role

Electric Transmission

- Utilities turn over control of transmission (liken to leasing out land)
  - Utilities receive Annual Transmission Revenue Requirement (depreciation/interest/maintenance) from RTO.
  - Utilities pay for use of transmission on a monthly basis (based on load via transmission segments)
  - RTOs are not for profit!

Markets

- Daily Process (complex, super computers, mega-data)
- Day Ahead Pricing
- Real-Time Pricing
- Post day true-ups

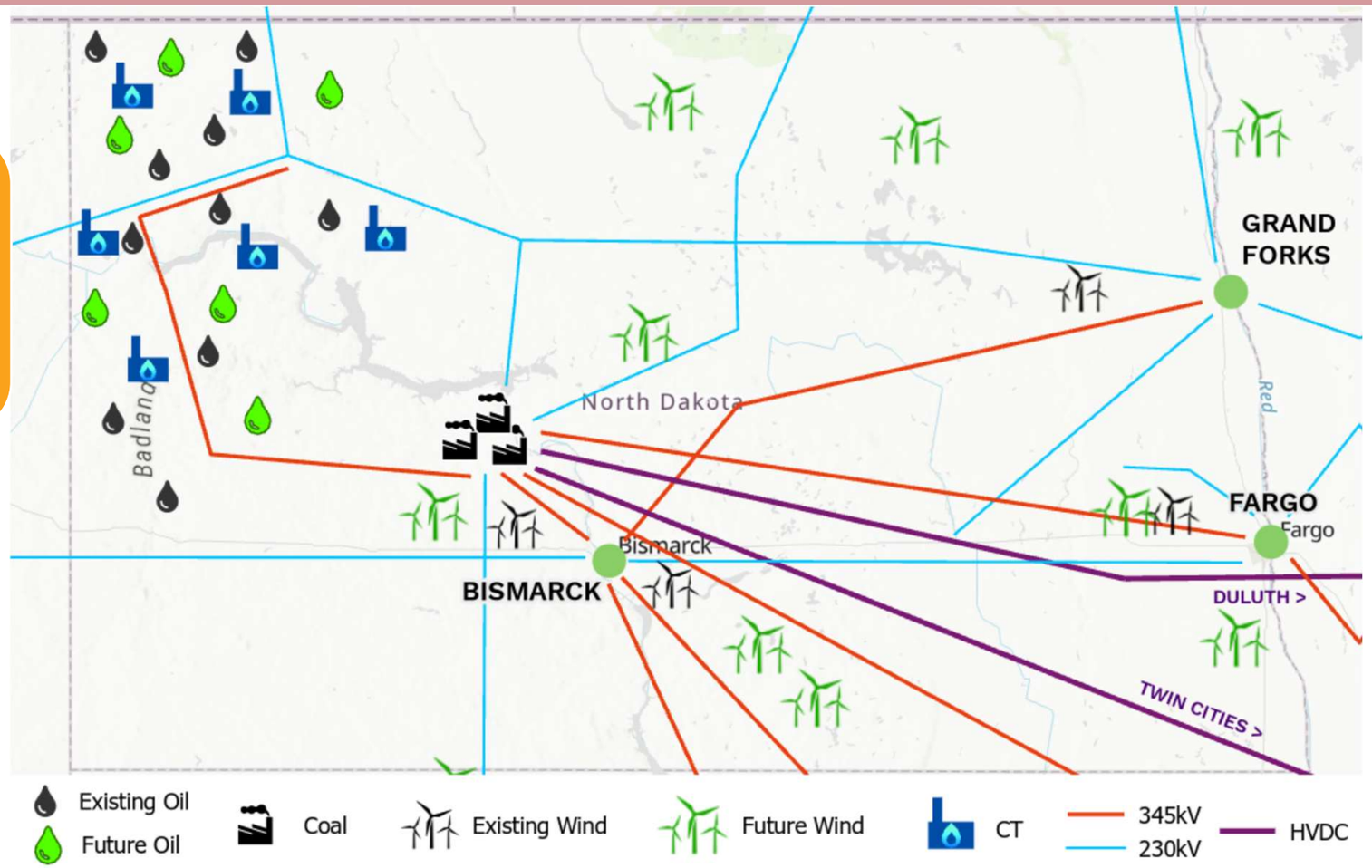
North Dakota Generation & Transmission Map

Not shown

115kV

60kv

41.6kV



North Dakota Transmission Authority

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North American Electric Reliability Council
NERC Winter 2022-2023 Reliability Risk

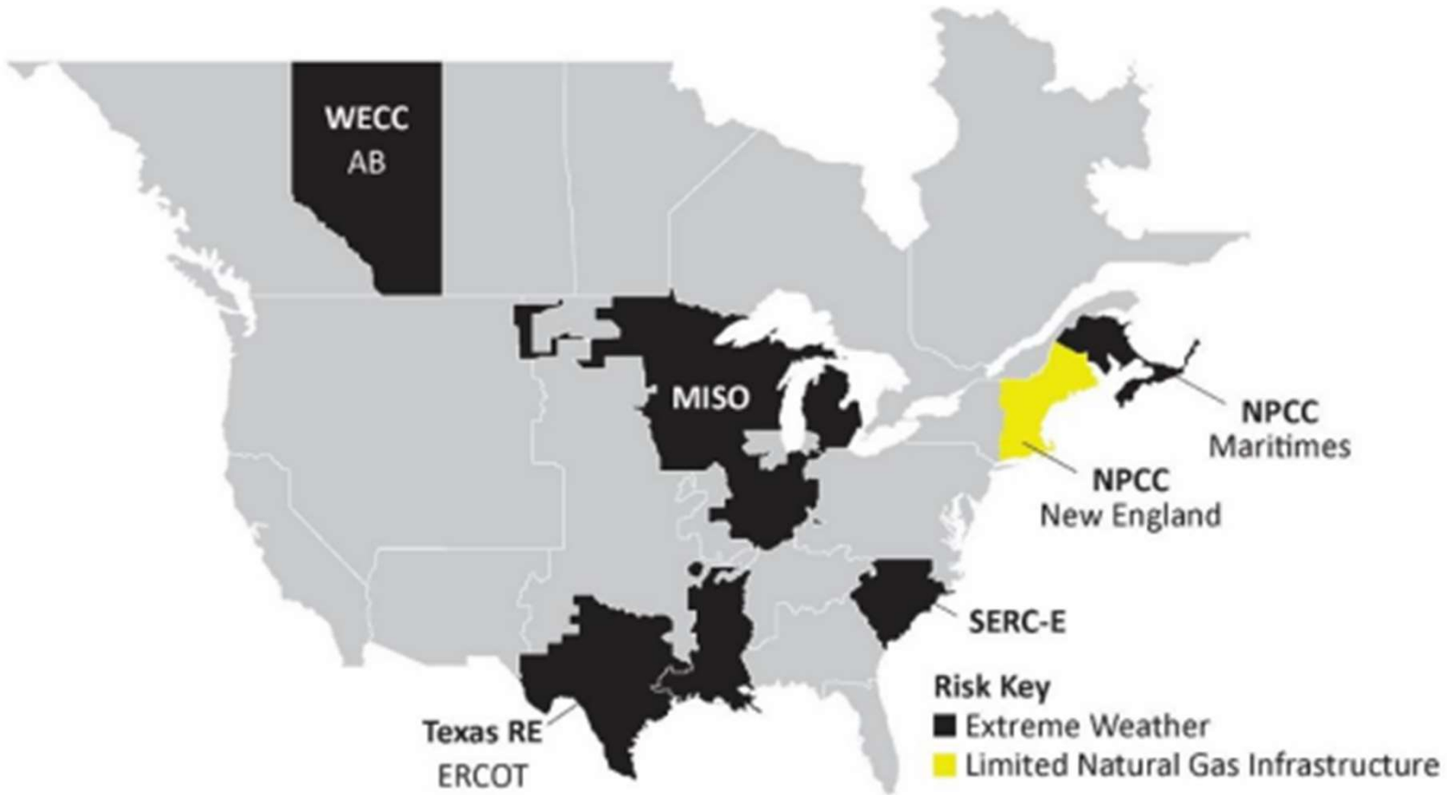


Figure 1: Winter Reliability Risk Area Summary

December 2022 generation shortage in grid in SPP (from Texas to Canada) and MISO (East Texas and Louisiana) and PJM

SPP impacts- Emergency operations, and wind performed well

MISO impacts- Emergency operations, and wind performed well to pull through

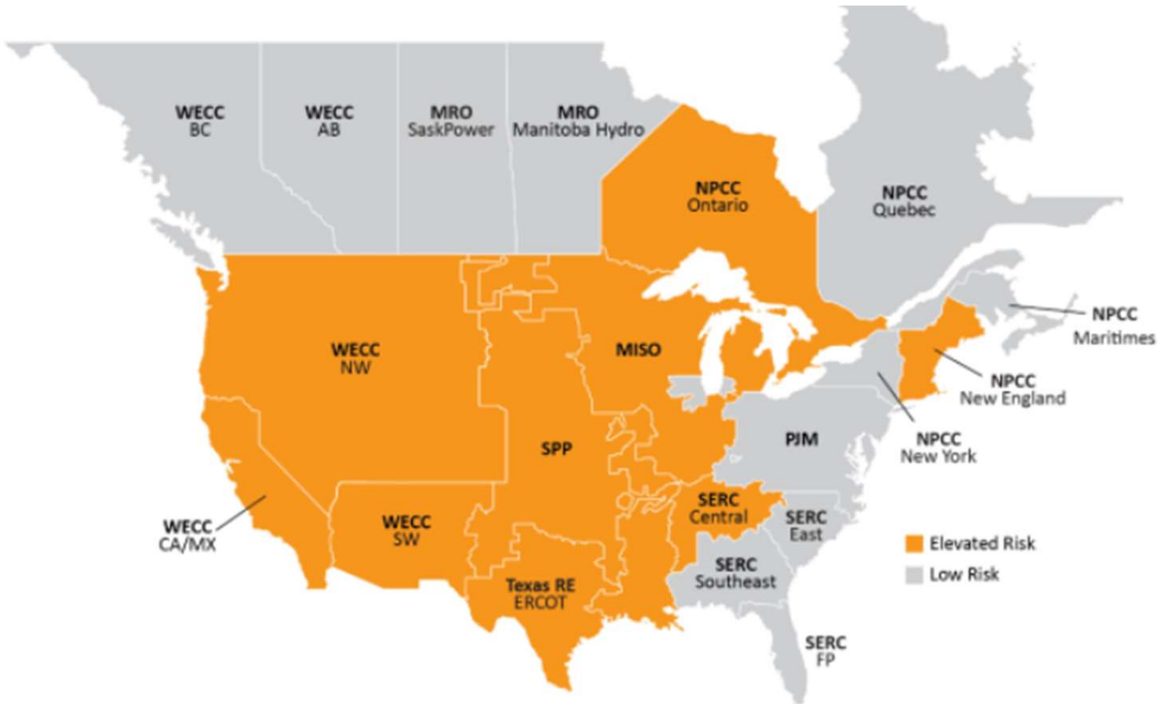
PJM impacts- gas units could not perform and no excess capacity to share with other regions

SE US- TVA and Duke had rolling blackouts

ERCOT- Texas had emergency operations

Northeast- utilities depended on oil for 40% of their supply

NERC Summer 2023 Reliability Risk



Seasonal Risk Assessment Summary	
High	Potential for insufficient operating reserves in normal peak conditions
Elevated	Potential for insufficient operating reserves in above-normal conditions
Low	Sufficient operating reserves expected

Figure 1: Summer Reliability Risk Area Summary

NEW REPORT DEVELOPED FOR NDIC / NDTA / LEC:

FORECASTING RESOURCE ADEQUACY IN SPP AND MISO POWER POOLS THROUGH 2035

Report by:

Isaac Orr, Mitch Rolling and Brent Bennet

Funded by:

The ND Enhance, Preserve and Protect Program

AMERICAN EXPERIMENT NORTH DAKOTA

Life:Powered

Lignite Energy Council

Objectives: Model Resource Adequacy and Cost in MISO and SPP Under Two Scenarios

Step 1: Develop Reasonable Accreditation Values for Wind and Solar

a. 2018-2022 hourly dataset
   i. Peak load availability.
   ii. Net peak load availability.

Step 2: Reference Scenario

- SPP/EIA planned additions (2.9 GW Gas, 1.4 GW Wind, 740 MW Solar, 60 MW Battery Storage) and retirements (2.9 GW Coal, 2.4 GW Gas, 40 MW Other) by 2035.
- Replace rest with modeled wind (15.7 GW), solar (23.2 GW), and four-hour storage (9.8 GW)
- Peak load and net load.

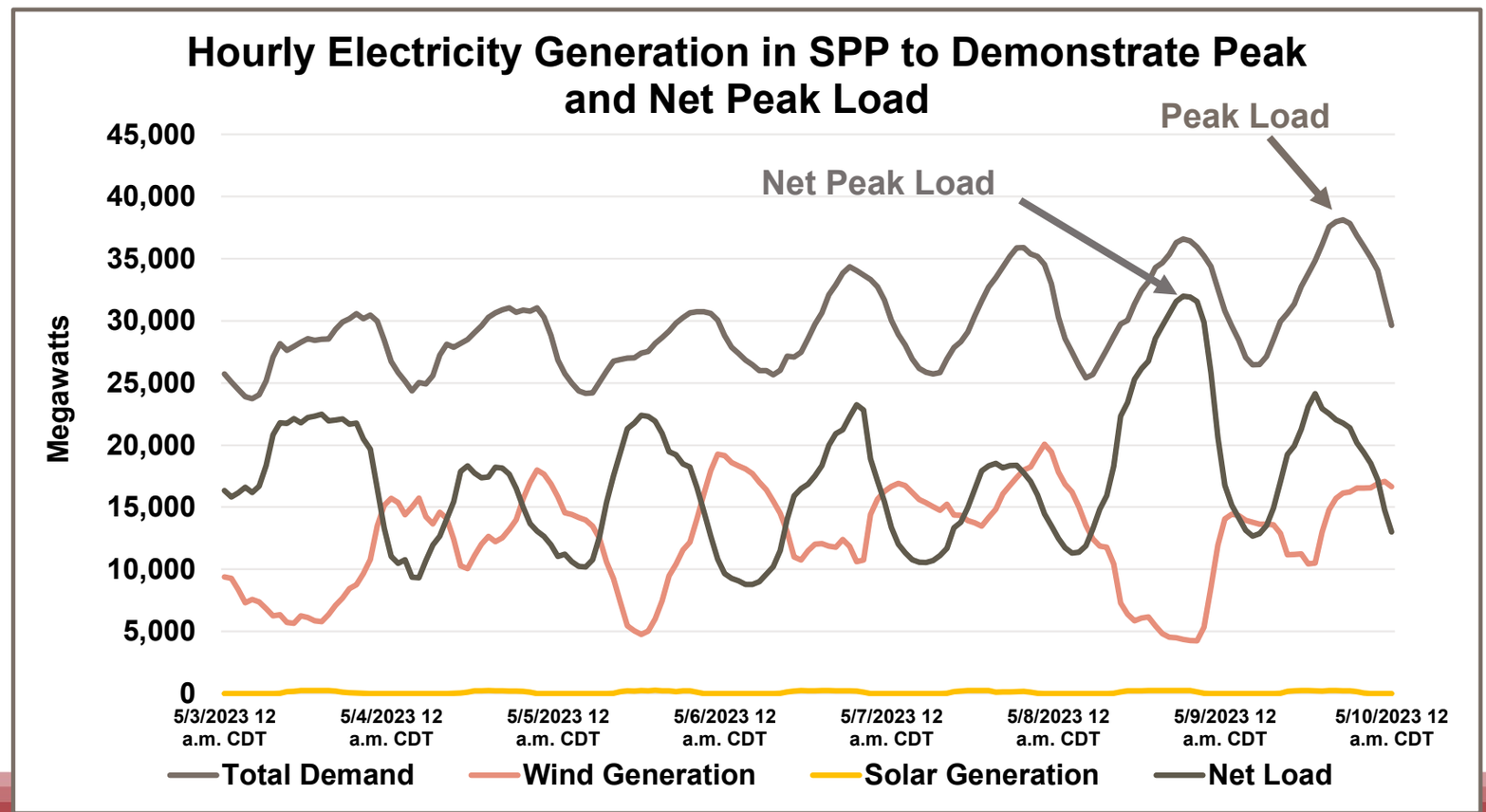
Step 3: Ozone Transport Rule (OTR) and Coal Combustion Residual (CCR) Scenario

- Loss of 22 GW of coal and 6.3 GW of gas by 2035.
- Replace with natural gas (2.9 GW), wind (69.7 GW), solar (101.7 GW), and four-hour storage (29.9 GW).
- Peak load and net load.

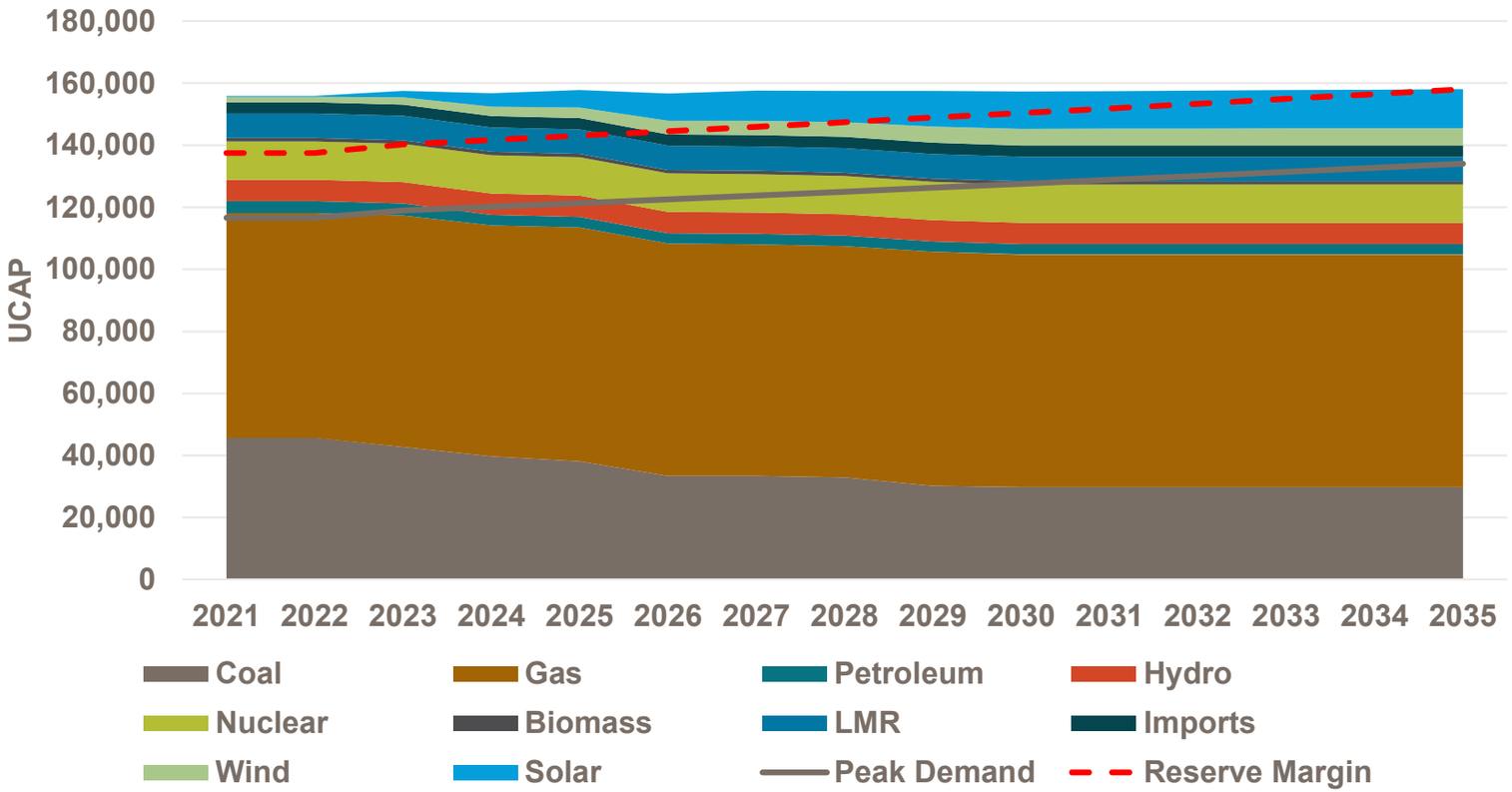
Methodology- Developing a Standardized Capacity Accreditation for Renewable Resources

- **Peak Load:** The hours with the highest electricity demand.
- **Net peak load:** Gross demand minus wind and solar generation, which allows us to assess the highest demand hours where wind and solar output is the lowest. This is the standard new wind and solar resources should be judged by going forward.

Assess wind and solar variability during peak load and net peak load hours



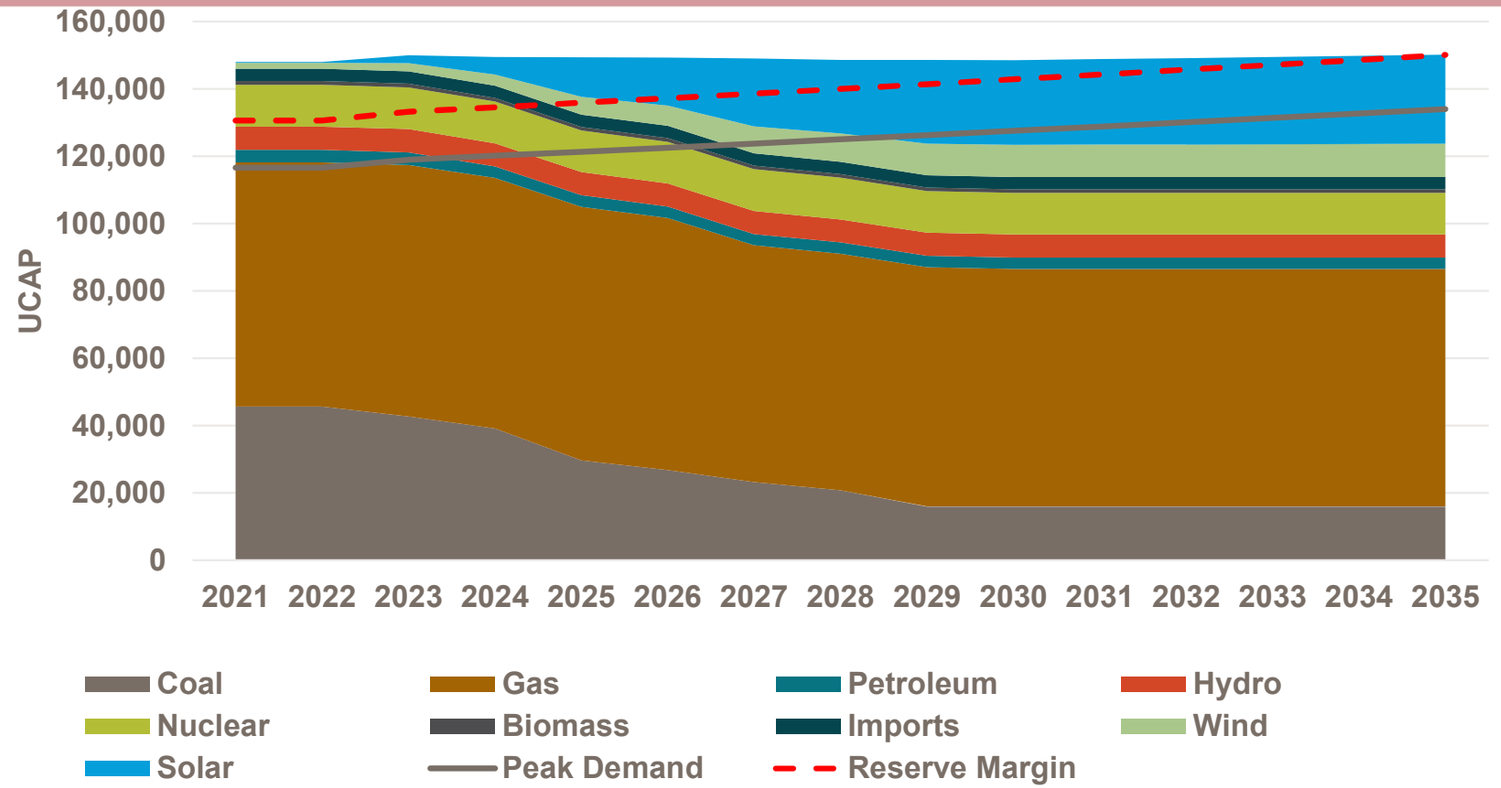
Even With No EPA impact
MISO Relying Upon Weather & Imports for Reserve



Year	Reserve Margin
2022	34%
2023	32%
2024	30%
2025	30%
2026	28%
2027	**27%**
2028	**26%**
2029	**25%**
2030	**23%**
2031	**22%**
2032	**21%**
2033	**20%**
2034	**19%**
2035	**18%**

Estimated firm capacity using net peak load capacity accreditation values for wind (5.8%) and solar (12%), 95% for nuclear, and 90% for other thermal generators. Different than MISO cleared UCAP (unforced [accredited] capacity).

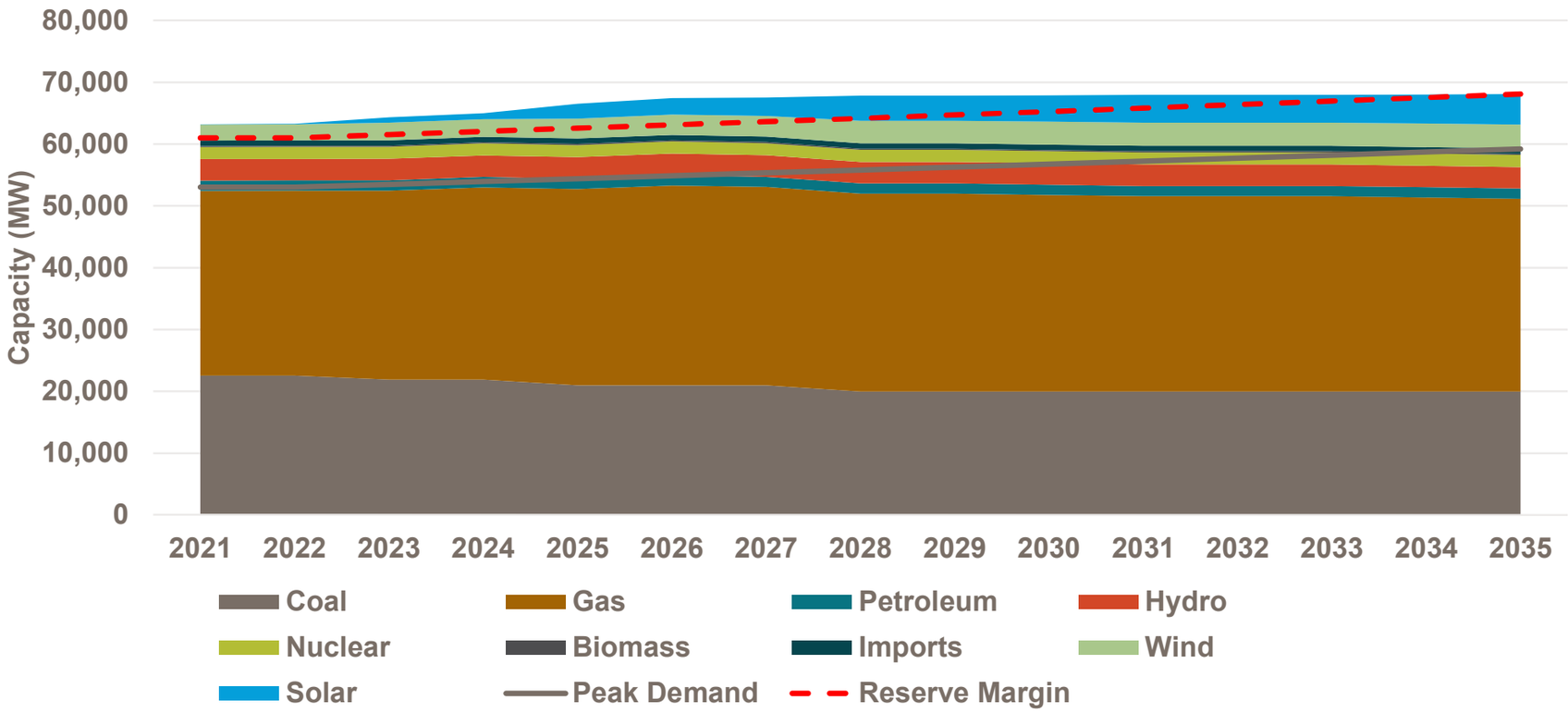
MISO OTR + CCR Scenario: Capacity Shortfall Risk



Year	Reserve Margin
2022	34%
2023	33%
2024	31%
2025	**30%**
2026	**28%**
2027	**27%**
2028	**25%**
2029	**24%**
2030	**23%**
2031	**22%**
2032	**21%**
2033	**20%**
2034	**19%**
2035	**18%**

Estimated firm capacity using net peak load capacity accreditation values for wind (5.8%) and solar (12%), 95% for nuclear, and 90% for other thermal generators. Different than MISO cleared UCAP (unforced [accredited] capacity). Under this scenario, MISO would be dependent on intermittent resources to meet peak load.

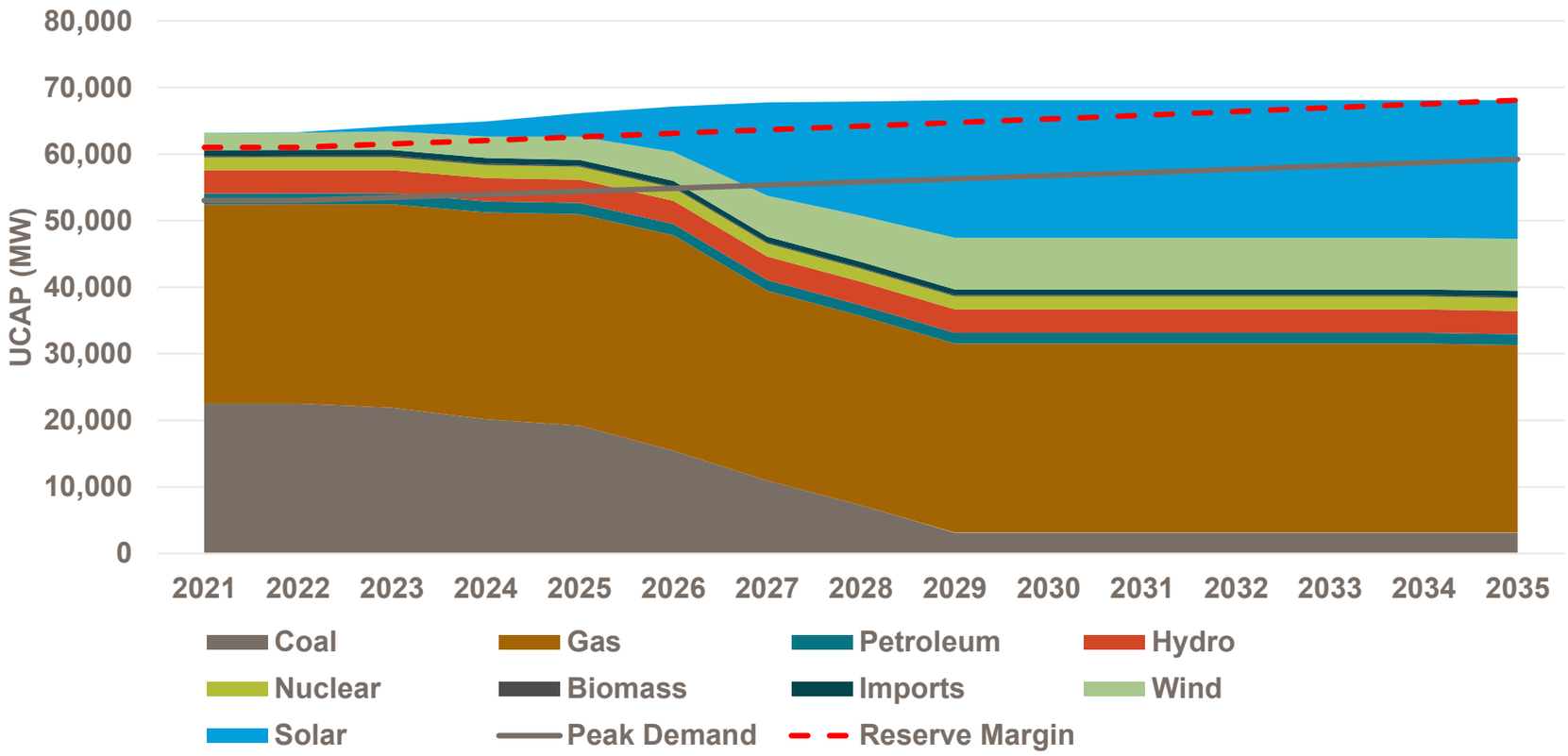
Even With No EPA impact, SPP Relying Upon Weather & Imports for Reserve at SPP



Year	Reserve Margin
2022	19%
2023	20%
2024	21%
2025	22%
2026	23%
2027	22%
2028	22%
2029	20%
2030	20%
2031	19%
2032	18%
2033	17%
2034	16%
2035	15%

Estimated firm capacity using net peak load capacity accreditation values for wind (7.5%) and solar (20.4%), 92% for nuclear, 88% for coal, 83% for natural gas, and 90% for other thermal generators.

OTR & CCR SPP Scenario: Capacity Shortfall Risk



Year	Reserve Margin
2022	19%
2023	**20%**
2024	**20%**
2025	**21%**
2026	**22%**
2027	**21%**
2028	**20%**
2029	**19%**
2030	**18%**
2031	**18%**
2032	**17%**
2033	**16%**
2034	**16%**
2035	**15%**

Estimated firm capacity using net peak load capacity accreditation values for wind (7.5%) and solar (20.4%), 92% for nuclear, 88% for coal, 83% for natural gas, and 90% for other thermal generators. Under this scenario, SPP is dependent on intermittent resources to meet peak load by 2026.

Tying these results together with MISO and SPP

- MISO and SPP do not have control over resource choices
- States have some control, mainly of investor-owned utilities, and require Integrated Resource Plans
- Some states have mandates that affect utility choice of resources
- Capacity markets have been ineffective in encouraging capacity
- Energy markets favor the lowest cost resource, so subsidized resources get selected to operate first
- Transmission capacity to get energy to market especially from dispersed renewable energy locations is seriously short
- Transmission capacity shortfalls result in lower market prices for all generation resource in a region

Continued work with MISO, SPP and Transmission owners

- The North Dakota legislature passed a resolution expressing our concern and shared it with MISO, SPP, FERC and others
- Several interest groups in North Dakota are working with MISO and SPP to encourage market design changes to incentivize generation that is dispatchable
- North Dakota is supporting Carbon Capture as a solution to keep dispatchable coal generation viable
- North Dakota interests are working with EPA to reach alternative solutions to the regulations that will negatively impact the resources on the grid
- The Resource Adequacy studies are being shared to heighten the awareness that accreditation of resources needs to be carefully thought through

IMPORTANT STEPS AHEAD FOR ND

- Recognize the huge investment in transmission capacity that will be needed
- Continue to support “all of the above” generation in North Dakota
- Advocate for market reforms that will adequately reward dispatchable capacity
- Prepare the public for the impact of transforming the grid in terms of land use, visual impacts and cost so landowner fatigue or rate payer resistance does not prevent the vision
- Adjust policies as needed to help provide investors a sound business solution with return on capital as well as operating expense
- Encourage investments in low or negative carbon technologies that will allow North Dakota to continue to be a leader in energy

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